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RECENT CHANGES IN BOGOSLOF VOLCANO

By SIDNEY POWERS, Ph.D.

Bogoslof, in Bering Sea, on the inner side of the Aleutian arc, is an unusual type of volcano, with pillar-like islands occasionally rising from the sea only to be in part or wholly destroyed by explosions. Since the earliest voyagers appeared in Bering Sea during the latter part of the eighteenth century, six islands have appeared, of which only three remain. These three peaks are now connected by sand bars and by the products of various volcanic explosions to form a single island.

The formation of the first island, Ship Rock, was reported by the earliest navigators about 1768, and the rock was not washed away by the powerful wave-attack of the open ocean until 1888. Old Bogoslof, now known as Castle Rock, was pushed from beneath the sea in 1796 as a solid rocky mass 4,000 feet in diameter and 350 feet in height. New Bogoslof (Grewingk or Fire Island) appeared in 1883 on the other side of Ship Rock from Old Bogoslof. The new island rose precipitously out of the sea to a height of over 800 feet, showing that it had been pushed out of an orifice in a very pasty condition instead of being formed of lava flows or ash which might accumulate around a crater.

Between 1883 and 1906 many changes took place in the forms of both Old and New Bogoslof, but no other islands were formed until March, 1906. In this month an island 2,000 feet in diameter and 400 feet in height appeared between Old and New Bogoslof. The names Perry Peak and Metcalf Peak were both given to this rock. The sides of the mass were described as being quite smooth and the top had the form of a "broken horn" as if the whole mass had been forced through an opening in the top of the submarine volcano. In the winter of 1906-07 half of Perry Peak was blown away and another spinelike mass rose not far away from the shattered side of Perry Peak. The new rock, McCulloch Peak, was about the same size and had the same form as the original Perry Peak, and, like the latter, was destroyed by an explosion ten months after its appearance, in September, 1907. Since this time nothing appears to have been published concerning the evolution of the volcano, and it is the aim of this paper to present what little information has been procured from the reports of government vessels.[1]

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[1] The early history of the volcano is described by C. Hart Merriam in "Bogoslof, Our Newest Volcano," report of the Harriman Alaska Expedition, Vol. 2, pp. 291-336, New York, 1902, abstracted by the author in the *Annual Rept. of the Smithsonian Institution for 1901*, pp. 367-375. T. A. Jaggar, Jr., visited Bogoslof in August, 1907, and describes the evolution of Metcalf and McCulloch Peaks in the *Bull. Amer. Geogr. Soc.*, Vol. 40, 1908, pp. 385-400. The material for the present paper was secured from the U. S. Coast Guard, and the writer is indebted to Mr. E. P. Bertholf, the Captain Commandant, for permission to publish the reports, with map, made in 1910 by Capt. J. H. Quinan of the U. S. Revenue Cutter *Tahoma*.

The explosion of September, 1907, which destroyed McCulloch Peak, left a circular hot lagoon where the rock had been (Fig. 1). The debris of the explosion was scattered over the beaches and bars which had connected Old and New Bogoslof and Perry Peak and was piled into ridges near Perry Peak and Fire Island (New Bogoslof). In July, 1908, the fragment of Perry Peak which remained since the explosion of 1906 is reported to have been no longer visible. The land between Old Bogoslof and Fire Island enclosed a deep bay, and some new land had been formed elsewhere. The absence of Perry Peak and the deep bay both point to another explosion in the winter of 1907-08.

Renewed activity in the bay between Old Bogoslof and Fire Island is reported in September, 1909. The bay had closed to form a lagoon, in which two small islands had risen, one of which gave off steam. The water in the lagoon was also constantly steaming. The two small islands were apparently just beginning to rise as new rocky spines, for on June 16, 1910, they are reported to have united and risen to a height of 178 feet above the lake level. Old Bogoslof, Fire Island, and the southwest shore of the lagoon remained the same as in the preceding year, but the new spines had become connected with the northeast shore of the lagoon, and a portion of the shore on that side had risen ten feet. Although the temperature of the salt lagoon ranged from 62° to 110° F., there was little activity in the new rock-masses and water was boiling up from only a few places near the lagoon.

A survey of Bogoslof Island was made on September 10, 1910, under the direction of Captain J. H. Quinan of the U. S. Revenue Cutter *Tahoma,* showing that the island was about one and a half statute miles long and three-quarters of a mile wide, as shown in Figure 2. The elevations of the peaks were: Fire Island, 175 feet; Castle Rock (Old Bogoslof), 289 feet; the higher of the two central peaks, 178 feet; the lower, 100 feet. The lower of the central peaks is given the name Tahoma Peak by Captain Quinan in his report, and the higher is called Perry Peak in spite of the fact that the remaining portions of Perry Peak were reported to have disappeared by July, 1908. In view of the records given above, it seems probable that Captain Quinan saw a new peak which rose in 1909-10 in the same place that Perry Peak occupied from 1906-08. No name is suggested for this new peak.

Steam issued from the base and sides of the new peaks at the time of the visit, and steam was issuing from the salt lagoon shown on the map. Between the new peaks and Fire Island, in the mud-covered area near the small lagoon, an area of several hundred yards was in violent agitation. Boiling water was being ejected through the mud, and in two pools, each about four feet in diameter, water was being thrown to a height of five feet by the rapidly escaping steam. Another seat of activity was on the northeast side of Tahoma Peak, at the edge of the main lagoon. Explosions had recently taken place here, according to Captain Quinan's report, and a group of steaming conical rocks had risen since the explosion. The water around these rocks was boiling, but not so violently as near the smaller lagoon. The temperature of the water in the main lagoon was found to be 107° F. on the south side of the new peaks and 90° F. at the end nearest Fire Island.

The eruptions at Bogoslof are much more frequent than recorded, because no vessels are in the vicinity, but fortunately Captain Quinan sailed back toward the island on September 18, and when about twenty-five miles away in the early morning witnessed an eruption. Forked lightning in the direction of Bogoslof was seen before daylight, and when Bogoslof was sighted the new central peak was seen to be in a state of eruption. Immense clouds of vapor, smoke, and ashes issued from the peak and enveloped the entire island. Flames were reported at the peak, and lightning followed by thunder appeared in the cauliflower cloud of smoke and volcanic dust which rose to a height of several thousand feet above the island. The eruption lasted during the several hours the steamer remained in the vicinity, and two days later the central peak was observed to be still steaming.

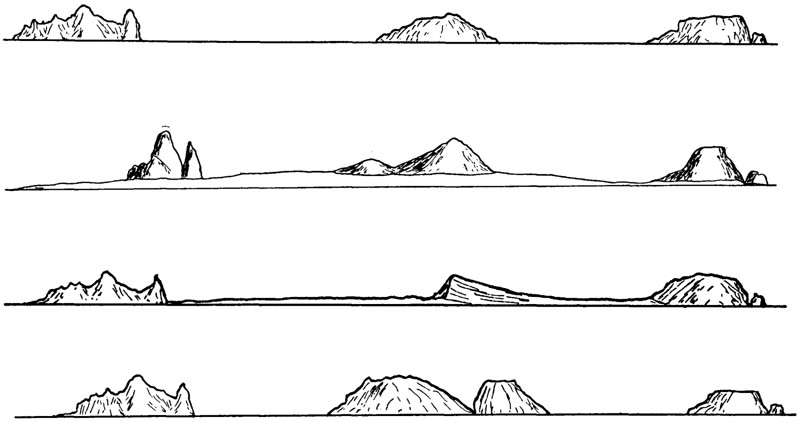

FIG. 1—Profile views showing the successive stages in the evolution of Bogoslof Volcano, from 1906-1910. (*Note:* The second and fourth profiles should be transposed. The explanation that follows refers to the correct order.)

In each of the sketches Castle Rock (Old Bogoslof) is on the left and Fire Island (New Bogoslof) on the right. In the first, Perry Peak is shown in the center as it was during the summer of 1906. In the second profile (August, 1907), Perry Peak remains as a half dome, and, on the side which has been blown away, McCulloch Peak appears. In the third profile, (September, 1907, after the explosion of McCulloch Peak), only a fragment of Perry Peak is left, and Old and New Bogoslof are connected by the debris of the explosion. During the interval between the third and fourth profiles the remainder of Perry Peak was destroyed, and, near the site, the two central peaks shown in the fourth sketch rose in 1909-1910 and are seen here in September, 1910. (The first three profiles are sketched from *Bull. Amer. Geogr. Soc.*, Vol. 40, 1908; the fourth is from the sketch by Lieut. A. H. Scally in 1910.)

The eruption of September, 1910, appears to have opened a true crater in the top of the central peak—the first important crater which has been reported on any of the masses of very viscous rock which have been slowly pushed out from the top of the submarine volcano to form the "rocks" and "peaks" of the last hundred and fifty years. The opening of a small crater is merely the closing stage of activity for the particular peak and corresponds to the explosions which destroyed Perry and McCulloch Peaks. The gas and vapor found a place of weakness where they could escape without blowing off the entire carapace which confined them.

There are no reports for 1911 or 1912, and in July, 1913, a brief statement refers to the crater as being plainly visible with steam and smoke slowly issuing from it. Activity apparently ceased during this year, for the commanding officer of the steamer *Patterson,* which passed Bogoslof on its way to pick up the survivors of the *Tahoma,* reports that "the Bogoslof Islands showed three peaks in 1914, none of which was smoking."

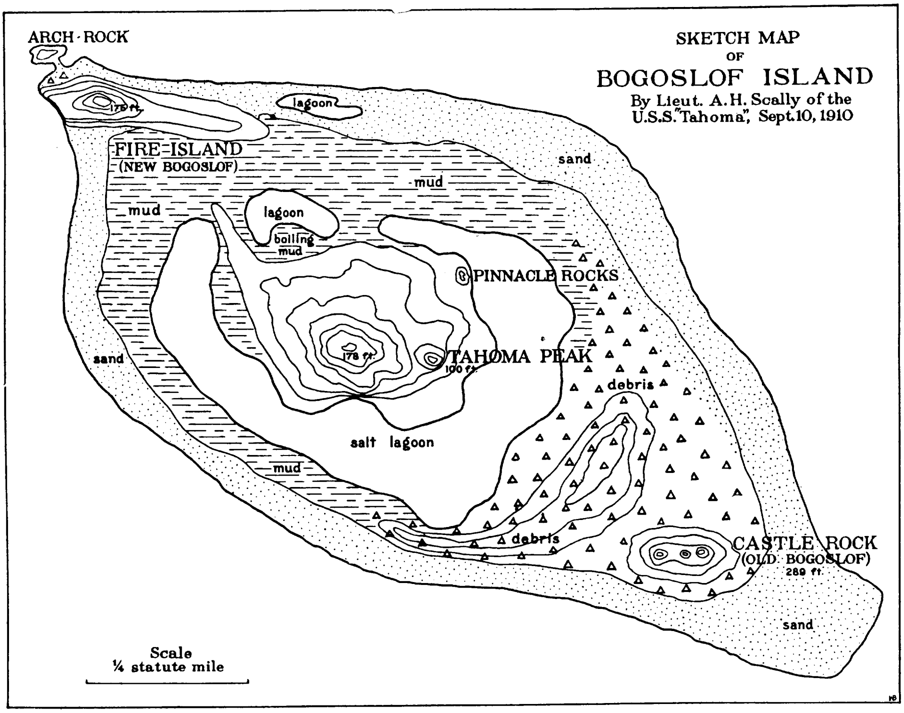

FIG. 2—Sketch-map of Bogoslof Island on September 10, 1910, showing Castle Rock, Fire Island, and the two new peaks in the center. Scale, 1:189,400. (From a map by Lieut. A. H. Scally of the U. S. S. *Tahoma.*)

No reports concerning Bogoslof since 1914 are at hand. And so it happens that this active submarine volcano rising from depths of a thousand fathoms goes unnoticed from year to year so far as scientific information is concerned, and, although the port of Unalaska is only about 60 miles away, many peaks may rise and be blown away with no record of the event.